UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Agricultural Economics

PROGRESS IN PRICE ANALYSIS AND AN APPRAISAL OF SUCCESS IN PRICE FORECASTING

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"The time is here when price research can begin to put the farmers of the land approximately on a level with the trade in understanding the market, and when in consequence the fluctuations in prices and production can begin to be reduced".1/ This is the statement with which last year I closed a discussion of Dr. J. D. Black's paper on Research in Prices of Farm Products,1/ and it is my text for today. In the past few years great progress has been made in price analysis. Much of the work is still in the experimental stage but many of the results already obtained are obviously capable of practical use in planning the production and marketing of farm products.

Planning for the most profitable product to be marketed so as to secure the greatest possible returns requires forecasting prices and price changes for at least one season ahead. I shall confine my discussion of price analysis today to a consideration of price analysis as a basis for forecasting prices.

Many, including some economists, shy at the idea of "forecasting prices". Last year Dr. Black voiced the sentiment of some when he said "that in the future it will be best to present the results of price analysis less as forecasts and more as statements of the statistical position of the product, making it clear that no forecast is intended".1/ In Research Method and Procedure in Agricultural Economics the Advisory Committee adopted the phrase "statistical inference" or "inductive inference" as a substitute for forecast.2/ These are good academic high brow labels for those who want to use "scientific names" for common things. Their use will sometimes avoid the criticisms of those who do not like the idea of forecasting and who do not understand that by "inductive inference" a forecast is intended. It is obvious, however, that in using the results of price analysis as a basis for adjusting production to marketing and for deciding when to sell, forecasts must be made and in language which everybody understands.

1/ Black, John D. Research in Prices of Farm Products. Journal of Farm Economics, v. 10, no. 1, January, 1928, p. 42-70.
2/ Social Science Research Council. Advisory Committee on Economics and Social Research in Agriculture. Research Method and Procedure in Agricultural Economics, v. 2, August, 1928, p. 271-276, 288.

Price forecasting is really nothing but the application of economic principles to practical economic problems. A century ago some of the English economists indulged in price analysis to a limited extent 3/ but since then, until recently, most economists have been satisfied to sit and spin theories without making any serious efforts to find quantitative measures of the forces of economic laws. The development of statistical technique in recent years is providing a means of measuring economic forces. In attempting to forecast the prices of farm products we are merely attempting to apply statistical methods and economic principles to some of the every day problems of the farmer.

Do we know now enough about what makes prices to forecast with confidence? Have we made sufficient progress in statistical methods to warrant us in assuming that we can make fairly accurate forecasts? Let us take a brief inventory of progress.

In the beginning of the present period of activity in price analysis most efforts were devoted to measuring and explaining changes in the general price level. From this developed theories of the business cycle and attempts to forecast the booms and depressions in business or the rises and declines in the general price level. We now have a world of literature on the general price level and the business cycle. Every one will admit that a fair degree of progress has been made in forecasting changes in business activity and in the general price level. This provides a basis for understanding and forecasting the price changes in farm products insofar as the business situation and the general price level affect them.

Moore stepped into the field of agricultural commodity price analysis to find an explanation of the business cycle and a basis for forecasting its course.4/ He became optimistic about the possibilities of forecasting the prices of cotton. Many students have followed him to realize that the problems in farm price analysis are perhaps more difficult than Moore had represented them to be. Nevertheless great progress has been made in the analysis of farm prices since Moore announced that it was possible for any person to forecast the price of cotton more accurately than the Department of Agriculture forecasts the yield of cotton.5/

In the meantime Warren at Cornell and Taylor at Wisconsin had started some research in farm commodity price analysis as an aid in the production and marketing of farm products. In the past ten years the Agricultural Colleges and Experiment Stations and the United States Department of Agriculture have done a great amount of work in this field. Working, 6/

3/ Rogers, James Edwin Thorold. A History of Agriculture and Prices in England from the year after the Oxford Parliament (1259) to the Commencement of the Continental War (1793). Oxford, Clarendon Press, 1866-1902. 7 v.

4/ Moore, Henry Ludwell. Economic Cycles: Their Law and Cause. New York, the Macmillan Co., 1914, p. 3.

5/ Moore, Henry Ludwell. Forecasting the Yield and the Price of Cotton. New York, the Macmillan Co., 1917, p. 10.

6/ Working, Holbrook. The Statistical Determination of Demand Curves. Quarterly Journal of Economics, v. 39, no. 4, August, 1925, p. 503-539.

Black 7/ and Hopkins 8/ have described the progress of research in this field. The behavior of the prices of several farm commodities has been studied, new statistical methods have been developed to measure the price making forces, and we now have had several years of experience in trying to apply the first results of price research including price forecasting to practical production and marketing problems.

In the field of price forecasting as in any other field of activity we can learn to do by doing. The Kansas Agricultural Experiment Station and the Bureau of Agricultural Economics have now had about four years of continuous experience in indicating for several farm commodities the probable course of prices from month to month or through some longer period of the marketing season. In 1925 after one year of experience, Prof. R. M. Green of Kansas, reviewing the forecasting experience of several agencies to that date said: "Batting averages in agricultural forecasting, in so far as it has been possible to investigate them, show about the same degree of perfection as human judgment has shown in other lines. At best agricultural forecasts are generally about 65 to 75 per cent perfect. There are some exceptions depending upon the length of time covered by the forecast and upon the purpose to be served". 9/

I now have from Professor Green a summary of his experience for 47 months and this experience appears to be in line with his observations three years ago. He reports wheat forecasts 83 per cent correct, hogs 77 per cent, corn 66 per cent, and cattle 60 per cent. (His measure of accuracy is the percentage of months in which the indicated direction of change in price is correct.) He has also summarized results by years. It is interesting to note the great variations from year to year in the accuracy of the forecasts. Taking wheat, for example, the forecasts for 1925 were 75 per cent correct; 1926, 100 per cent; 1927, 83 per cent; 1928 to date, 75 per cent correct. The accuracy of the hog and cattle forecasts likewise varied greatly through the four years. These results point to the great variations in results that are likely to be met in dealing with different commodities and different seasonal conditions.

The experience of the Bureau of Agricultural Economics with forecasts published in the monthly price situation from September, 1924 to date parallels that of the Kansas Experiment Station. Not so many direct price forecasts have been made. We are more cautious than Professor Green. A recent check of our direct price forecasts indicates that about 87 per cent of all such forecasts proved to be correct. The percentage of accuracy for several different commodities has ranged from 83 for cattle to 91 for butter.

Mr. Harold Hedges of Nebraska has summarized for me his experience from September, 1927 to August, 1928. Like Professor Green he attempts to give a fairly definite indication of the course of prices for every month in the year. He reports at least 80 per cent of all his forecasts in the year correct. About 10 per cent he would class among the misses and 10 per cent debatable.

7/ Black, John D. Research in Prices of Farm Products. Journal of Farm Economics. v. 10, January, 1928, p. 47-60.
8/ Hopkins, John A. Jr. The Forecasting of Economic Phenomena. Iowa State College Journal of Science, v. 2, no. 4, July, 1928, p. 268-276.
9/ Green, R. M. Batting Averages in Agricultural Forecasting. Journal of Farm Economics, v. 8, no. 2, April, 1926, p. 174.

Dr. Hedden and associates of the Port of New York Authority, tried last year (1927) an interesting experiment in forecasting the receipts and prices of a few perishables marketed in New York City. For several years they had been making various forecasts and decided to let the interested public follow and make practical use of such forecasts for a season. They dealt with peaches, cantaloupes and watermelons. They forecasted prices for each week of the season and most of the forecasts were in dollars and cents. On peaches I would score their forecasts about 75 per cent correct as to direction of changes. In a majority of the cases the value forecasts were accurate enough to be useful guides in marketing the peaches. They estimated the course of the New York City prices of cantaloupes more accurately than the course of the peach prices, but after the first week overestimated the price per crate through most of the season. The forecasts of prices f.o.b. Imperial Valley and Arizona shipping points were somewhat more accurate than the forecasts for New York City. The watermelon price forecasts hit one hundred per cent. At the beginning of the season the prices of watermelons from Florida and Georgia were forecasted to be considerably higher than in the previous season and this was borne out. The forecasts of price changes during the season were also borne out almost precisely as forecasted.

The price forecasts in the outlook reports of the Bureau of Agricultural Economics are somewhat different in character from the market season forecasts. They are forecasts of long time trends or for at least a marketing season a year ahead. Many of them, of course, are conditioned upon production. Taking into account these qualifications the price forecasts in the outlook reports have been about 90 per cent correct.

Many other state and private agencies have in the past few years indulged to some extent in the forecasting of the prices of agricultural commodities, but the experiences that I have described ought to be sufficient to indicate what can be done on the basis of present knowledge of prices and methods of analyzing and forecasting prices.

I believe that the experiences which I have described are sufficient to warrant the conclusion that the trend a year ahead, the monthly or seasonal, and in some cases the weekly, price changes can be forecasted by fairly well trained statistical economists with an exception of about 80 to 90 per cent accuracy.

What degree of accuracy reasonably may be required to justify public support of price forecasting? Obviously one hundred per cent cannot be required and chance will give fifty per cent accuracy. According to the Weather Bureau, the forecasts of weather in the Washington District in the period 1915-19 were about 85 per cent correct for the 36-hour period following the forecasts. This service has been established for many years and is generally considered to be a valuable service. For the ordinary man are not prices about as difficult to forecast as the weather? When a farmer has a product about ready for market is he not about as much interested in the price of his product as he is in the weather through the growing and harvesting season? We must not let a few failures in price forecasting shame us out of the field. But we must add something to the judgment of the ordinary man as to what his product is worth, what it is likely to be worth tomorrow,

in the course of the marketing season and the trend into the next season at least.

Let me illustrate the possible significance to farmers of some improvement in their knowledge of the real value of a product and the probable course of prices through a marketing season. I will use cotton as an illustration.

Analysis of past experience indicates that producers of cotton have a tendency to be guided both as to area planted and use of fertilizer by the prices realized for the last crop. The outlook report of the Department is intended to provide the producer in advance of planting, information that will be useful to him in adjusting his production to prospective demand or, what is to him more important, probable prices for his crop to be produced. As long as cotton producers generally continue to base their plantings upon the prices or profits for past years we can give cotton producers a fairly good indication in January of the area of cotton that is likely to be planted, and the quantity of fertilizers likely to be used.

Having an indication as to whether the acreage is to be increased or decreased, the producer needs to know how this change is likely to affect prices. From an analysis of the demand for cotton and the relation of prices to supplies it is possible to indicate to farmers a fairly accurate schedule of prices for different sized crops. For example, the average relationship between the world's supplies of American cotton and New Orleans prices adjusted to demand and price level for the past season, 1927-28, indicates that under conditions prevailing then a supply of 16½ million bales would sell for 26 cents. Add two million bales and the price would fall to nearly 22 cents; add four million bales and it would fall to 19½ cents. Stated in another way, with a carryover of about five million bales of American cotton a 12 million bale crop would sell for about 25 cents, a 15 million bale crop would sell for about 20 cents, and a 20 million bale crop would reduce the price to 15 cents. These are concrete interpretations of the relation of variations in size of crop to variations in price in terms anyone can understand.

Having decided how much to plant and how much fertilizer to use, the next question is: How much cotton shall be carried over this season into next? An analysis of prices and carryover in past years indicates that there is a fairly definite relationship between carryover and price. As long as this relationship continues we can indicate as early in the season as we can determine the average price for the year the probable carryover of American cotton at the end of the season. As soon, therefore, as we can make an estimate as to the probable production, we can indicate whether or not it may pay to carry over some of the old cotton crop into the next season.

The planning of the marketing of the new crop must begin as soon as the crop begins to come to market. Some cotton is ready for market in July. We ought, therefore, to make early in July the best possible guess of the probable supply for the season. In doing this, however, it must be recognized that in July a large part of the cotton crop remains subject to weather conditions. The experience of the past few years indicates that by the first of September the crop can be estimated fairly accurately. By this time the carryover can be calculated fairly accurately. The estimated carryover plus

the forecast of the crop, therefore, would give a fairly accurate estimate of the world's supply of American cotton for the season. The marketing policy then can be planned on the basis of the real value of the crop and the relation of present prices to this value and the probable course of prices through the remainder of the year.

Let us examine the possibility of planning the production and the marketing of the crops of the past two seasons, 1926 and 1927, on the basis outlined above. In 1926 the Outlook Report definitely and clearly warned Southern farmers against the expansion of the area in cotton. It was stated that a production resulting from a yield larger than the average, on an acreage equal to that of the past season, could easily result in a price too low to render a profit to large numbers of producers, and "obviously the situation might be aggravated if the acreage were increased". In spite of this warning, farmers added a million acres to the 1925 area. The result was not only no compensation for the increase in expenditure for planting and harvesting the million acres, but also a reduction of 450 million dollars in the value of the crop below that of the 1925 crop.

A part of the loss from over-production in 1926 might have been avoided by planning the marketing of the crop. Reports of the Bureau of Agricultural Economics indicate that marketings for this season followed about the normal course. Prices in August and September were relatively high. In October, November and December they fell. Toward the end of the season prices again rose and ended nearly where they began the season. Knowing the real value of the crop, producers should have sold all they could in August and September and stopped when prices fell below the real value of the cotton for the season. Holding until after prices reached the level of real value until they were again offered this price or better would have stabilized the marketing and added millions of dollars to the pockets of the producers of the cotton.

The Bureau Outlook Report for 1927 suggested a cut of 30 per cent in acreage. Farmers were induced by the low prices they had received for the past crop to reduce acreage 14.6 per cent and to reduce the amount of fertilizer used upon the crop. Had they followed the advice of the Bureau and cut the acreage 30 per cent, they would have provided a better market for the carryover from the 1926 crop and realized a greater return for the new crop, and at the same time considerably reduced expenses of production and greatly increased their income.

By taking into consideration the area that was planted and the prospects for the new crop, the marketing of the 1927 crop could have been planned so as to increase income. The 1926-27 season closed with a boom in the cotton market. This boom had been stimulated by heavy consumption of cheap cotton and the rise in prices from the low point of the season toward the end of the year. The high prices reached at the end of this season and the beginning of the 1927-28 season offered farmers an opportunity to sell their new crop early. The price in September was considerably higher than the probable average for the year. Knowing this, farmers should have attempted to sell all of their crop at these prices. The entire crop was sold many times in the futures market in August and September and I see no reason to believe that the sale of 12 or 13 million bales of real cotton would have had any material influence upon that speculative boom. Under the conditions then prevailing cotton

producers probably could have disposed of their entire crop in late August and early September at prices above the average actually realized for the season.

Let us examine the course of prices in the 1928 season to date. The crop is larger than last year but the carryover has been reduced so much that the total supply of American cotton for the season is less than last year. The price in August and September, however, moved directly opposite to last year. From September through November prices have risen. Had farmers refused to sell early in the season until prices reached their present level they would have gained from 30 to 40 million dollars by such a policy. Summarizing our observations on the 1926, 1927, and 1928 season to date it is obvious that many producers would have greatly increased their income by planning the production of their crops on the basis of the probable effect of their plantings upon production and the prices likely to be received for the product, and by planning the marketing of the crops that had been produced on the basis of their real value in relation to the probable course of prices in the marketing season.

Similar opportunities for gain by planning production and marketing, in view of th prospective demand and probable prices, will be found in dealing with other farm products.

I believe that the publication of the results of price analysis, basic material and methods used in forecasting will in itself do much toward stabilizing the market for agricultural products. This may seem to be claiming too much. Let me make my meaning clear by restating this proposition. Publication of methods of analysis and forecasting together with the basic data gives many more people the basis for determining the real value of a farm product, with the result that competition tends to bring the price at any time in the season nearer to the actual value of the product than is now realized through the higgling of the market upon the basis of various interpretations and misinterpretations of facts. I do not intend to say that the publication of basic data and methods of forecasting is sufficient. This alone would not give those who are not able to use the methods a basis for valuing a product. I mean to advocate that agricultural statisticians should both interpret facts in terms of price forecasts for farmers and give to the public full statements of facts and methods, in order that competition in the market may be keener and more definitely focused on the real value of the product.

Let me go further and say that I do not believe that price forecasting will tend to fix prices nor will it eliminate fluctuations in prices or speculation as to these fluctuations. In the long run conditions of supply and demand will determine prices. For short periods speculation will continue to affect prices. There will always be some room for difference of opinion as to what will happen to change supply and demand or whether or not the situation at any given time has been measured with absolute accuracy by anyone. For example, it may be found by analysis that supply alone has explained 90 per cent of the average annual price of hogs for a period of years, but it may happen that in a year facing you at any given time the demand situation is so much changed that it will have a very material effect upon the price of hogs; and successful analysts or forecasters must estimate the significance of the change in the demand situation on the basis of little or no experience

with such a condition. I would not say that because such things happen now and then forecasting is useless and cannot be relied upon as a basis for marketing programs. The man who is thoroughly familiar with supply and demand conditions that affect price will not be entirely at a loss in attempting to measure the significance of a change in demand, but there will be plenty of room for differences in the judgment of different people in making an estimate of the significance of a change in demand. In the case of crops there will always be a period of uncertainty as to the outturn of the next crop. Improvements in any forecasts may tend to reduce this, but cannot eliminate the uncertainty. The contribution of price analysts will be in indicating more accurately the price significance of any indicated probable change in the quantity to be produced or marketed.

In conclusion I would say that enough is known about what makes prices to enable competent analysts to forecast with confidence that the price forecasts are likely to be accurate enough to be useful to farmers in planning production and marketing, and that this will tend to reduce fluctuations in production and in price to the advantage of both the producer and the consumer.

I do not mean to suggest that we should be satisfied to stop with the progress to date in price analysis. Far from it. We need and must have greater precision in analysis. All the data need some improvement and in most cases more data are needed to make a complete analysis. With all the improvements in the past few years the methods of analysis in many cases are still crude; they are still in the experimental stage. There is need for the intensive and continuous research that refines methods and thoroughly tests results. Most price research workers have too many other things to do. They need more time for research and more time to become thoroughly familiar with the production and marketing of the commodities with which they are dealing. There is also room for great improvement in the art of forecasting. The forecasts should be as clear cut and definite as possible and accompanied by information that will assist the interested parties in deciding how the forecast affects or should affect their activities. Let us hope that we may have as rapid progress in these directions in the next ten years as we have had in the past decade.

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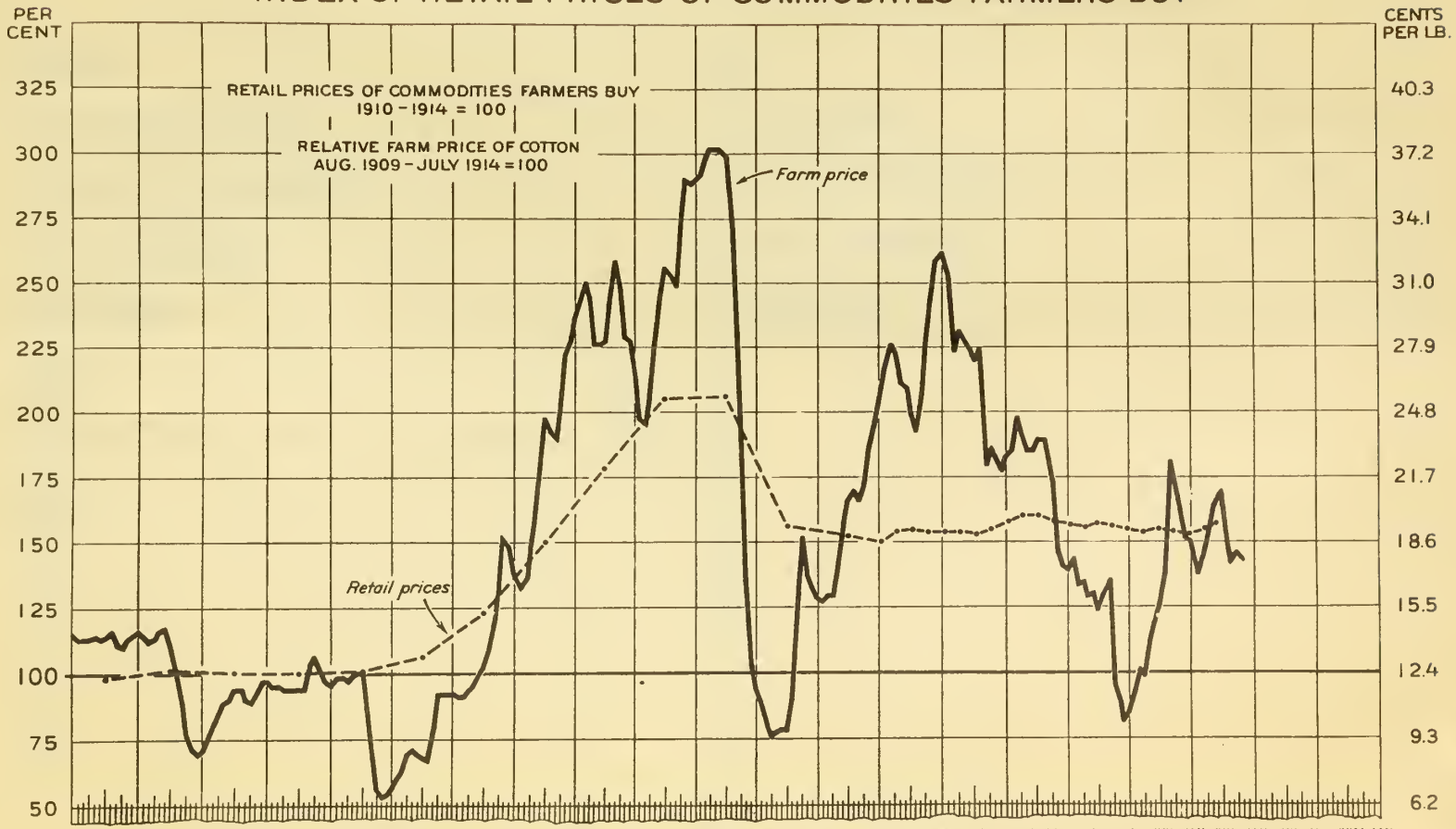
FARM PRICES OF COTTON
AND
INDEX OF RETAIL PRICES OF COMMODITIES FARMERS BUY



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COTTON: FARM MARKETINGS AND FARM PRICES
MARKETINGS PER CENT OF YEARS SALES
PRICE PER POUND CENTS
1926 - 1927
40
30
20
10
0
20
15
10
5
0
Price
Marketings
AUG. SEPT. OCT. NOV. DEC. JAN FEB. MAR APR. MAY JUNE JULY
50
40
30
20
10
0
25
20
15
10
5
0
1927-1928
Price
Marketings
AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUNE JULY
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